UNPUBLISHED PRELIMINARY DATA

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A continuing effort was made during the last six months to define the philosphical and scientific objectives of a versatile and practical experiment designed to provide

a) a direct detailed, accurate, and well documented analysis of the Martian atmosphere and

b) knowledge of the nature of chemical compounds which may be found on the surface of Mars

In view of what is not known of conditions on Mars certain physicochemical experiments seemed very much worth considering for an early mission. These relatively simple experiments do not require an a priori knowledge of the planetary environment and are not limited to Earth biochemistry. In part they seek

1. the omnipresence of intense orderliness of chemical structures and of events utterly improbable on a basis of thermodynamic equilibrium

2. extreme departures from an inorganic steady state equilibrium of chemical potential.

After a sobering confrontation with the engineering constraints to be encountered in placing instruments in the vicinity of the planet let alone on its surface - it appeared that one of the most feasible approaches was that which involved the use of controlled programmed heating of surface samples with the subsequent separation of the evolved volatile, semi volatile, and finally degradation products by means of high resolution gas chromatographic columns. With the advent of some recent startling advances in mass spectrometry it appeared possible to procure sufficient mass spectra for structural identification of each individual chemical component that could be separated in this manner in a matter of a few seconds. With this information at hand it should be possible to predict with a high degree of certainty the chemical nature and the degree of ordered sequences of some of the original organic moieties present in the sample prior to degradation. By the addition of a simple differential thermal analysis (DTA) device to the gas chromatographic sample oven, evidence for chemical non-equilibrium can be assessed. Thus in sharp contrast to certain 'growth' or 'wet' chemistry systems for life detection where one may obtain an equivocal yes or no answer, this experiment should provide a wealth of information in the form of reliable, precise and hopefully familiar data that will serve as a cornerstone for a subsequent and more sophisticated mission.

In essence then the technology is now at hand to construct a relatively simple, reliable, and exceedingly versatile combination

gas chromatography-mass spectrometry instrument. It would weigh somewhere between 10 and 15 pounds and prior to landing on the surface of the planet it could provide one with a detailed analysis of the Martian atmosphere. Under these circumstances it should have the unique capacity of carrying out several well defined objectives of a first mission to Mars.

At the present time in this laboratory a high resolution mass spectrometer is being set up to work in combination with a gas chromatographic system. Once this combination is in effect-in collaboration with JPL personnel-efforts will be directed toward the elucidation of many of the scientific principles and parameters necessary for the construction of a 'breadboard' flight instrument package in order to adequately achieve the goals of the experiment.

Publications during this 6 month period.

Lovelock, J.E. and Lipsky, S.R. "A Physical Basis for Life Detection Experiments"
Submitted for publication to Nature (10 copies enclosed)